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SPECIFICATION FOR STYRENE-BUTADIENE RUBBER LATEX

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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February 1986

Indian Standard

SPECIFICATION FOR STYRENE-BUTADIENE RUBBER LATEX

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(*Continued on page* 13)

Indian Standard

SPECIFICATION FOR STYRENE-BUTADIENE RUBBER LATEX

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 22 March 1985, after the draft finalized by the Rubber Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

0.2 The type of latex covered in this standard corresponds to the commercially known S-2000 latex; this number is allotted by the International Institute of Synthetic Rubber Producer's Inc, USA.

0.3 Styrene-butadiene latex is used for tyre cord dipping, compounding adhesives for footwear and paper industry, carpet backings, upholstery and linings for proofed goods like fire fighting hoses, etc.

0.4 In preparation of this standard, assistance has been derived from ISO 2006-1974(E) 'Synthetic rubber latex — Determination of high speed mechanical stability' published by the International Organization for Standardization.

0.5 In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

1. SCOPE

1.1 This standard prescribes the requirements and methods of sampling and test for styrene-butadiene rubber latex.

2. REQUIREMENTS

2.1 This standard covers hot polymerized styrene-butadiene type copolymer latex which is non-staining and emulsified with rosin acid soap emulsifier.

---

*Rules for rounding off numerical values (*revised*).

2.2 The material shall comply with the requirements given in Table 1 and Appendices A, B, and C of this standard. Reference to the relevant methods and appendices are given in col 5 and 6 of Table 1.

TABLE 1 REQUIREMENTS FOR STYRENE-BUTADIENE RUBBER LATEX

Sl No.	Characteristic	Requirements		Methods of Test, Ref to	
		Min	*Max*	Appendix	IS :
(1)	(2)	(3)	(4)	(5)	(6)
i)	Total solids content, percent by mass	40	44	—	IS : 9316 (Part 4)-1979*
ii)	Residual styrene, percent by mass	—	0·10	—	SBRL : 8 of IS : 4511 (Part 1)-1967†
iii)	*p*H	10·5	11·5	—	IS : 9316 (Part 6)-1982‡
iv)	Mooney viscosity ML_{1+4} at 100 °C	60	90	A	—
v)	Bound styrene, percent by mass	44	48	—	SBRL : 9 of IS : 4511 (Part 1)-1967†
vi)	Surface tension, mN/m	47	55	—	IS : 9316 (Part 1)-1979§
vii)	Relative density at 27/27°C	—	0·99	—	SBRL : 60 of IS : 4511 (Part 1)-1967†
viii)	Average particle size	800°A	1 200°A	B	—
ix)	Coagulum content, percent by mass of total solids	—	0·1	—	IS : 9316 (Part 3)-1977||
x)	Mechanical stability, coagulum percent by mass	—	0·1	C	—

*Methods of test for rubber latex: Part 4 Determination of total solids content.

†Methods of test for styrene-butadiene rubber (SBRL) latices: Part 1 Determination of dry polymer, total solids, coagulum, *p*H, surface tension, density, viscosity, residual styrene, bound styrene and soap content.

‡Methods of test for rubber latex: Part 6 Determination of *p*H.

§Methods of test for rubber latex: Part 1 Determination of surface tension.

||Methods of test for rubber latex: Part 3 Determination of coagulum content.

3. PACKING AND MARKING

3.1 Packing — The latex shall be packed in epoxy coated mild steel drums or as agreed to between the purchaser and the supplier.

3.2 Marking — The containers shall be marked with the following:

a) Name of the manufacturer or trade-mark, if any;
b) Net and gross mass in kg; and
c) Month and year of packing.

3.2.1 The containers may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act, and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions, under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

4. SCALE OF SAMPLING AND CRITERIA FOR CONFORMITY

4.1 The method of drawing representative samples of the material and criteria for conformity shall be as prescribed in Appendix D.

APPENDIX A

[*Table* 1, *Sl No.* (iv)]

DETERMINATION OF MOONEY VISCOSITY

A-1. OUTLINE OF THE METHOD

A-1.1 The rubber portion of a latex is separated by a salt-acid methanol coagulation, dried and massed on a mill. The viscosity of the rubber is measured on a Mooney viscometer.

A-2. APPARATUS

A-2.1 High Speed Agitator — waring blender or similar blender.

A-2.2 Drying Trays — 30 × 20 × 2·5 cm with coarse screen bottom.

A-2.3 Draft Oven — capable of maintaining 120 ± 5°C.

A-2.4 Laboratory Mill

A-2.5 Mooney Machine — with large rotor.

A-3. REAGENTS

A-3.1 Sulphuric Acid — 18 percent (*v*/*v*).

A-3.2 Sodium Chloride Solution — 10 percent (*m/v*).

A-3.3 Phenyl Beta Nephthylamine Solution — 0·75 percent (*m/v*) phenyl beta naphthylamine solution in methanol.

A-4. PROCEDURE

A-4.1 Dilute the total solids content of the latex with distilled water to approximately 30 percent. Add to 250 ml of the diluted latex, 50 ml of the 10 percent sodium chloride solution and mix thoroughly. Stir the creamed latex in a waring blender and add 250 ml of phenyl beta naphthylamine solution in 50 to 60 seconds. Continue agitation for 2 to 3 minutes. During this period slowly add 10 ml of 18 percent sulphuric acid. If the coagulating solution does not turn Congo red paper from red to blue, add additional sulphuric acid while stirring until the colour does change.

A-4.2 Pour the contents in the coagulating cup on cheese cloth and allow the mass to drain. Press as much serum as possible from the mass. Pull the mass apart, wash thoroughly, till free of acid and transfer the pieces to a drying tray. Keep it for about an hour before determining the Mooney viscosity.

Dry the crumb in a draft oven at 120 ± 5°C for approximately 45 minutes. Mill mass the rubber and determine between 10 to 30 minutes Mooney viscosity as given in NR: 8 of IS : 3660 (Part 1)-1972*.

APPENDIX B

[*Table* 1, *Sl No.* (viii)]

DETERMINATION OF PARTICLE SIZE OF LATEX

B-1. OUTLINE OF THE METHOD

B-1.1 Particle size of latex is determined by turbidity measurements in the visible region in a UV/Visible Spectrophotometer. Turbidity of latex is proportional to the particle size in the absorption range of 0·07 to 0·1 at 700 nm.

B-2. APPARATUS

i) UV/Visible Spectrophotometer
ii) 80 ASTM mesh screen
iii) 100 ml volumetric flasks
iv) Balance

---

*Methods of tests for natural rubber: Part 1 Determination of dirt, volatile matter, ash, total copper, manganese, iron, rubber hydrocarbon, viscosity (shearing disc viscometer), and mixing and vulcanizing of rubber in a standard compound (*first revision*).

B-3. PROCEDURE

B-3.1 Strain latex through 80 mesh stainless screen and determine total solids content. Weigh accurately about 1 g (± 0·002 g) of latex into a clean dry 100-ml volumetric flask. Immediately add approximately 30 ml of distilled water to the latex sample to prevent formation of agglomerates or skin on latex during its brief exposure to air. Dilute to the mark with distilled water and mix thoroughly. Pipette 5 ml aliquot of the above latex solution into another clean 100 ml volumetric flask and dilute to make with distilled water. Stopper the flask and mix thoroughly.

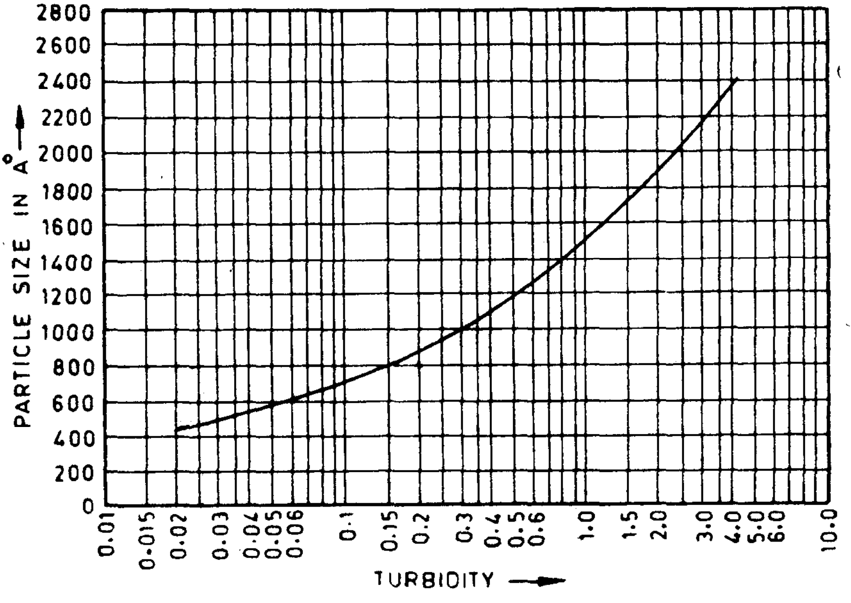
Determine absorbance at 700 nm using distilled water as blank. If absorbance does not fall between 0·07 to 0·10, different dilutions must be tried.

B-4. CALCULATION

$$\text{Turbidity} = \frac{\text{Absorbance}}{\text{g/1 000}}$$

$$= \frac{\text{Absorbance} \times 1\ 000}{\text{Sample mass} \times \dfrac{\text{percentage total solids}}{100} \times \text{Volume of aliquot}}$$

B-4.1 Read particle size of latex in Å from the graph of turbidity versus particle size using Fig. 1.



Scale of the graph on y axis
One small square = 40Å
λ = 7 000 Å

FIG. 1 FOR LOW SOLIDS LATICES (BELOW 50 PERCENT TOTAL SOLIDS)

APPENDIX C

[*Table* 1, *Sl No.* (x)]

DETERMINATION OF MECHANICAL STABILITY

C-0. GENERAL

C-0.1 The test method given below specifies for the determination of the high-speed mechanical stability of synthetic rubber latex. The test is applicable to synthetic rubber latices which have a viscosity, determined with the *L* instrument in accordance with IS : 9316 (Part 2)-1979* of up to 200 mPa s (200 cP). Latices of higher viscosity shall be tested after dilution to a viscosity of 200 mPa.s (200 cP) or less, provided that such dilution does not reduce the concentration of the latex by more than 10 percent total solids.

NOTE — Dilution of the latex decreases its stability because the balance of free and absorbed soap is changed.

C-0.2 The duration of stirring shall be so selected that the latex does not increase in temperature to more than 60°C and does not exceed a height of 100 mm in the latex container. The duration of stirring shall be as agreed to between the purchaser and the supplier and shall not be longer than 30 min or less than 1 min. In the case of a latex which contains ammonia, the duration of stirring shall be limited, since loss of ammonia by evaporation during the test may cause additional destabilization.

C-0.3 The test does not necessarily indicate the stability of a synthetic rubber latex to high shear stress, for which a rubbing test may be more applicable.

C-1. OUTLINE OF THE METHOD

C-1.1 The amount of coagulum formed after stirring of the latex at high speed, is regarded as an inverse measure of the mechanical stability of the latex.

C-2. REAGENT

C-2.1 Soap Solution — 5 percent solution of potassium oleate of *p*H value 10, or, for use with a latex which is coagulated by potassium oleate solution, 5 percent solution of a synthetic anionic surfactant.

C-2.2 Distilled Water — *See* IS : 1070-1977†.

C-3. APPARATUS

C-3.1 Mechanical Stability Measuring Apparatus — consisting of the following items.

---

*Method of test for rubber latex: Part 2 Determination of viscosity.

†Specification for water for general laboratory use (*second revision*).

C-3.1.1 *Latex Container* — flat bottomed cylindrical, at least 100 mm high, with an internal diameter of 58 ± 2 mm. The inner surface shall be smooth, and a glass container is preferred.

C-3.1.2 *Stirring Apparatus* — consisting of a vertical stainless steel shaft of sufficient length to reach to the bottom of the latex container (**C-3.1.1**) and tapering to 6·35 mm diameter at its lower end, where is attached a horizontal, smooth, stainless steel disk 36·12 ± 0·03 mm in diameter and 1·58 ± 0·05 mm thick by means of a threaded stud at the exact centre of the disk. The apparatus shall maintain a stirring speed of 14 000 ± 200 rev/min throughout the test, at which speed the shaft shall not run out of true by more than 0·25 mm.

C-3.1.3 *Holder* — for the latex container (**C-3.1.1**). The holding arrangement shall ensure that the axis of the rotating shaft is concentric with that of the latex container and that the bottom of the stirring disk is 13 ± 2 mm from the inner surface of the bottom of the latex container.

C-3.2 Preliminary Filter — of stainless steel wire cloth with an average aperture width of 180 ± 15 μm.

C-3.3 Test Filter — consisting of a disk of stainless steel wire cloth with an average aperture width of 180 ± 15 μm, dried to constant mass and weighed to the nearest 1 mg, firmly clamped between two stainless steel rings of equal internal diameter between 25 and 50 mm.

C-4. PROCEDURE

C-4.1 In case viscosity of the latex determined with the *L* instrument [according to IS : 9316 (Part 2)-1979*] exceeds 200 mPa.s (200 cP), dilute it to this or a lower value, with an amount of water which reduces the concentration of the latex by not more than 10 percent total solids.

C-4.2 Adjust the temperature of the latex to 25 ± 3°C, pass it through the preliminary filter (**C-3.2**) and transfer 50 ± 0·5 g to the latex container. Place the container (**C-3.1.1**) in position and stir the latex at 14 000 ± 200 rev/min for 30 min, such that the latex does not increase in temperature to more than 60°C and does not exceed a height of 100 mm in the container. If it is necessary to limit foaming, a paste of a silicone defoamer shall be smeared around the upper portion of the inner surface of the container. Immediately after the termination of stirring, remove the latex container and wash the stirrer shaft and disk free from latex deposits with soap solution. Wet the test filter (**C-3.3**) with soap solution and pour the latex and washings into the test filter. Use soap solution to ensure quantitative transfer of all latex and deposits including skin. Wash the residue on the test filter with soap solution until it is free from latex and then with water until the washings are neutral to litmus. Carefully remove the test filter containing the wet solid matter and swab the underside with filter paper. Dry the test filter and coagulum at 100 ± 2°C until the change in mass is less than 1 mg during 15 min drying.

---

*Method of test for rubber latex: Part 2 Determination of viscosity.

C-5. EXPRESSION OF RESULTS

C-5.1 The high-speed mechanical stability of the latex shall be reported as the percentage of coagulum which is formed. Calculate it as a percentage by mass of the latex, using the formula:

$$\text{Coagulum, percent by mass} = \frac{M_1 \times 100}{M_0}$$

where

M_0 = mass, in g, of the test portion; and
M_1 = mass, in g, of coagulum.

APPENDIX D

(*Clause* 4.1)

SCALE OF SAMPLING AND CRITERIA FOR CONFORMITY

D-1. TANK SUPPLIES

D-1.1 When the material is supplied in tanks or other bulk containers, each tank or bulk container shall be sampled separately.

D-1.2 A representative sample shall be drawn from each tank of bulk container according to **6** of IS : 9316 (Part 5)-1979*.

D-1.3 The sample shall be tested for all the requirements given in Table 1. The material in tank or bulk container shall be considered as conforming to this specification if the corresponding representative sample satisfy all the requirements given in the specification.

D-2. DRUM SUPPLIES

D-2.1 Lot — All the drums, in a single consignment, of the same size and belonging to same batch of manufacture shall constitute a lot.

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*Methods of test for rubber latex: Part 5 Drawing of samples.

D-2.2 For ascertaining the conformity of material to the requirements of this specification samples shall be tested from each lot separately.

D-2.3 The number of drums (*n*) to be selected for sampling shall depend on size of the lot (*N*) and shall be in accordance with col 1 and 2 of Table 2.

TABLE 2 SCALE OF SAMPLING

LOT SIZE (*N*) (1)	NO. OF DRUMS TO BE SELECTED (*n*) (2)
Up to 25	3
26 to 50	5
51 to 100	7
101 and above	10

D-2.4 These drums shall be chosen at random from the lot. In order to ensure the randomness of selection, reference may be made to IS : 4905-1968*. In case this standard is not readily available, following procedure may be adopted:

> Starting from any drum in the lot, count them as 1, 2, 3, ... up to *r* and so on in one order, where *r* is the integral part of *N*/*n*. Every *r*th drum thus counted shall be withdrawn to constitute the required sample size.

D-3. METHOD FOR TAKING SAMPLES FROM SELECTED DRUMS

D-3.1 From each of the drums selected according to **D-2.3**, a representative sample shall be drawn in accordance with the procedure prescribed in **5** of IS : 9316 (Part 5)-1979†.

D-4. TEST SAMPLE AND REFEREE SAMPLE

D-4.1 From the samples (**D-3.1**) representing different drums in the lot a small but approximately equal quantity of material shall be taken and thoroughly mixed to form a composite sample, not less than 600 g. The composite sample so obtained shall be divided into three equal parts, one for the purchaser, another for the supplier and third for the referee.

---

*Methods for random sampling.

†Methods of test for rubber latex: Part 5 Drawing of samples.

D-4.2 The remaining portions of the material in the samples (**D-3.1**) shall be divided into three equal parts, each forming an individual sample. One set of individual samples representing the containers selected (*n*) shall be for the purchaser, another for the supplier and third for the referee.

D-4.3 All the individual and composite samples shall be transferred to separate containers. Each container shall then be sealed air-tight with stoppers and marked with full details of sampling, the date of sampling, year of manufacture, batch or code number and other important particulars of the consignment.

D-4.4 The referee sample consisting of a composite sample and a set of individual samples shall bear the seals of both the purchaser and the supplier and shall be kept at a place agreed to between the two. This shall be used in case of any dispute between the two.

D-5. NUMBER OF TESTS

D-5.1 Tests for determination of total solid content shall be conducted on each of the individual samples.

D-5.2 Tests for remaining characteristics shall be carried out on the composite sample.

D-6. CRITERIA FOR CONFORMITY

D-6.1 The lot shall be declared as conforming to the requirements of the specification if **D-6.1.1** and **D-6.1.2** are satisfied.

D-6.1.1 The test results on each of the individual samples for total solid content, satisfy the corresponding specification requirements given in Table 1.

D-6.1.2 For remaining characteristics given in Table 1, all the test results on the composite sample meet the corresponding specification requirements given in Table 1.

(*Continued from page* 2)

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	k
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	$1\ \text{N} = 1\ \text{kg.m/s}^2$
Energy	joule	J	$1\ \text{J} = 1\ \text{N.m}$
Power	watt	W	$1\ \text{W} = 1\ \text{J/s}$
Flux	weber	Wb	$1\ \text{Wb} = 1\ \text{V.s}$
Flux density	tesla	T	$1\ \text{T} = 1\ \text{Wb/m}^2$
Frequency	hertz	Hz	$1\ \text{Hz} = 1\ \text{c/s}\ (\text{s}^{-1})$
Electric conductance	siemens	S	$1\ \text{S} = 1\ \text{A/V}$
Electromotive force	volt	V	$1\ \text{V} = 1\ \text{W/A}$
Pressure, stress	pascal	Pa	$1\ \text{Pa} = 1\ \text{N/m}^2$